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- Programmable Scanner
- Repairing PC Boards

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Autumn 1978

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Probe: High input impedance FET connected in a source follower circuit. Input Modes: A selectable ceramic filter. Tuned inputs covering the standard broadcast i-f frequencies (262 kHz, 455 kHz, and 10.7 MHz, untuned rf and audio. Semiconductors: Three integrated circuits, three transistors, and five diodes. Controls: Volume, band switch, coarse attenuator switch, fine attenuator/on/off switch, am/fm switch. Power Requirements: 110-120 volts ac, 60 Hz. Dimensions: 8½” wide by 6” high by 6½” deep. Shipping Weight: 6 pounds (13.2 kg).
In this issue,
Journal editor/publisher
Bill Dunn surveys one of
the hot new applications of
microcomputer technology, the
programmable scanning receiver.
And, certainly not to be outdone,
NRI student/author Steven L.
Williams tells us how to handle
repairs on those delicate PC
boards with precision,
finesse, and savoir
faire.

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Ever since fire and police departments began using radio communications, it has been a popular pastime to monitor these broadcasts. The first fire and police radios operated in a band just above the high-frequency end of the standard AM broadcast band. Often you could hear some of these stations on an ordinary broadcast receiver. When the fire and police departments moved to the VHF and UHF bands and the use of radio for all types of communications increased, it became impractical to try to tune all these different services with a continuous tuning receiver. Then, with the advent of transistors and integrated circuits, scanners came on the market that could scan a number of presелected channels and automatically stop on any channel on which a signal was picked up and remain there until the end of the transmission.

The trouble with the first scanners was that the oscillator was crystal-controlled and a separate crystal was needed for each channel. If you bought enough crystals to cover most of the available activities in any area, you could easily end up with as much money invested in crystals as in the original scanner.

Radio Shack® recently introduced a programmable FM scanning receiver Model PRO-2001 (manufactured by Realistic®, a division of the Tandy Corporation) which eliminates the need for all these crystals. This model will scan 16 channels plus a monitor channel in any combination in the VHF-low band (30 to 50 MHz), the VHF-high band (144 to 174 MHz), and the UHF band (430 to 512 MHz). The receiver uses two CMOS RAMs (random access memories), one microprocessor IC, 29 integrated circuits, 40 transistors, 69 diodes, a seven-digit LED frequency display, and 17 LEDs (light-emitting diodes). The receiver, which is a superheterodyne, operates on 120 volts, 60 Hz or 12 to 15 volts dc. It includes a digital synthesizer which can be programmed on 16,560 different frequencies. A photograph of the PRO-2001 programmable scanner is shown in Fig.1.

For a receiver that has such capability, the scanner is relatively easy to operate. The first thing you have to do is remove the battery compartment cover and install a nine-volt battery. This battery is needed because the scanner contains an electronic memory. Without the battery, the channels you have programmed into it would be lost when the power was turned off.

Once you have the nine-volt battery in the battery compartment, you connect the UHF and VHF antennas to the antenna jacks, plug the receiver in, and you are ready to start.

Let's suppose that the local fire department is operating on a frequency of 154.140 MHz and you want to enter this frequency on Channel 1. To do this, turn the equipment on by rotating the VOLUME control (which can be seen at the lower left in Fig.2) about one-quarter turn. Press the SCANNER key on the right and then press in all the channel switches. Rotate the SQUELCH control fully counter-
clockwise. You should hear a rushing sound from the speaker. Now adjust the SQUELCH control clockwise until you no longer hear the rushing background noise.

In approximately the center of the receiver under Channel 8 is the scanning switch marked AUTO on top and MANUAL on the bottom. When this switch is in the AUTO position, the receiver will scan automatically. When the switch is in the MANUAL position, you have to keep moving it down to move one channel at a time.

Manually operate the scanning to get the receiver to Channel 1. When you have it on Channel 1, the Channel 1 indicator LED will light. Now press the PROGRAM key. The PROGRAM LED will light up. Next use the calculator-type keyboard to enter the frequency 154.140. Press the ENTER key on the lower right of the receiver and the frequency is now stored in Channel 1,
and will be displayed by the seven-digit digital frequency display.

You can now use the scanning switch to move the receiver to Channel 2 and store a different frequency in this channel. The frequency need not be in the vhf-high band. It can be in this band or it can be in the 30 to 50 MHz or 430 to 512 MHz band.

One channel that you'll probably want to set up is the National Weather Service. Different frequencies are used in different parts of the country, but you should find the Weather Service on either 162.400 MHz, 162.475 MHz, or 162.550 MHz.

Now that you have Channel 1 set at 154.140 MHz, move the receiver manually by means of the scanning switch to Channel 2. Once again press the PROGRAM button and the PROGRAM LED will light up. Enter the frequency 162.400 and then press the MONITOR button on the right of the scanner. If you hear the Weather Service, press the ENTER button and the frequency will be stored in Channel 2.

If you do not hear the Weather Service, press the CLEAR button and this will wipe out 162.400 MHz. Now enter 162.475 MHz and once again press the MONITOR button. If you hear the station, press the ENTER button and this frequency will be stored in Channel 2; if you do not hear it, once again press the CLEAR button and then enter 162.550 MHz. You should hear the Weather Service on one of these frequencies.

**FINDING A STATION**

Earlier we explained how to set up the local fire station operating on 154.140 MHz and Channel 1. However, suppose you do not know the frequency on which the fire station operates, but you still want to set it up on Channel 1. You can use the search function to find the station. Fire stations operating in the vhf-high band operate in the frequency band 154.130 to 154.445 MHz. The scanner will scan this frequency band for you and find the station.

Press the SCANNER key to select Channel 1. Set the squelch control to a point where the annoying background noise just stops. Press the PROGRAM key. The PROGRAM LED will come on. Press the LO key and then punch the numbers for the lower frequency

**NORMAL SCANNING**

If you know the frequencies of the various services in your locality which you wish to monitor, you can move the receiver to Channel 3 and then to 4 and so on, setting up one of the frequencies on each channel. Once you have 16 frequencies stored in the receiver, switch the scanning switch to AUTO, and press the SCANNER key; the receiver will begin scanning the various channels automatically. Push the DELAY switch up when the receiver stops on a channel. Since there is a signal present, it will not go on to the next channel until two seconds after the transmission is ended. Therefore, if two stations are transmitting on the same frequency and one is replying to the other, you won't miss the reply because the scanner has moved on.
limit, which in this case will be 154.130 MHz.

Now push the UP key and punch the numbers for the upper frequency limit, which in this case is 154.445 MHz. Press the FS (fast search) or SS (slow search) key to start the search. You can change the searching speed any time by pressing either the FS or SS key. When the scanning monitor finds a station, press the MONITOR button. This halts the search and stores the frequency of the station in the MONITOR memory and lets you listen for a while.

If this indeed is the fire station, you can enter this frequency into Channel 1, or any other channel that you have selected, by pressing the ENTER button.

If you find that the station you have on the monitor is not the station you are looking for, you can resume the search where you left off by pressing the FS or SS key. When you find a second station, once again press the MONITOR. This new frequency will now replace the contents of the monitor memory, and if it is the correct station it can be stored permanently into the channel you have selected for it.

You might at first hear no stations at all as you search the selected frequencies. That’s all right. When the search reaches the upper frequency limit (154.445 MHz, in this example), it will automatically start searching again at the lower frequency limit. The search operation will continue until you change the operating mode.

**HOW IT WORKS**

The heart of this scanner is a microprocessor which is receiving signals from a number of sources and sending out control signals in other directions. A microprocessor is frequently referred to as a “computer on a chip.” By this we mean that practically an entire computer is contained within a single integrated circuit. The microprocessor is just starting to come into its own. It is going to create an unbelievable growth in the field of electronics.

Figure 3 is a simplified block diagram of the scanner. Notice that there are three rf amplifier, mixer, and oscillator sections, one for each of the vhf bands and one for the uhf band. A signal from the shift register actuates the band switch which determines which band is selected. The oscillator section uses a voltage-controlled oscillator. This is simply an oscillator that uses a varactor diode across the frequency-determining circuits. The voltage applied to the varactor determines the capacity of the varactor and hence the frequency at which the oscillator operates.

In addition to feeding a signal from the oscillator to the mixer, a signal is also fed through the buffer amplifier back to the programmable counter. On the vhf bands, the counter divides the signal to produce a 5-kHz output signal. For example, when the receiver is tuned to 154.140 MHz, one of the channels we set up earlier, the oscillator will be operating 10.7 MHz higher or at 164.840 MHz.

The divider divides this signal by 32,968 to produce a 5-kHz signal in the output. Meanwhile, the 6.4-MHz oscillator also has a divider in the circuitry that divides the 6.4-MHz signal by 1280 to produce a 5-kHz signal. These two 5-kHz signals are fed to the phase detector where their frequency and phase are compared; if the signal from the programmable counter is not exactly in phase with the signal from the oscillator, a correction voltage is developed that is fed through the low-pass filter to the oscillator to bring the oscillator to the correct frequency. You might wonder how the programmable counter knows that it should divide the
oscillator signal by 32,968. The answer is that it is given this information by the microprocessor.

On the uhf band, the stations are spaced 12.5 kHz apart. To provide the internal signal needed to convert the incoming signal to a 10.7-MHz i-f signal, the local oscillator generates a signal that is fed through a tripler to the mixer. The signal from the oscillator is also fed to the programmable counter. In shifting from one uhf channel to the next, the oscillator frequency shifts 12.5 kHz \( \div 3 = 4.1666 \) kHz.

When the receiver is tuned to a uhf channel, for example 467.7375 MHz, the signal from the tripler will be 10.7 MHz above this frequency or 478.4375 MHz. The oscillator operates at one-third this frequency or 159.479 MHz. This signal is divided by 38,275 to produce a 4.1666-kHz signal.

Meanwhile, the signal from the 6.4-MHz oscillator is divided by 1536 to produce a 4.1666-kHz signal. The two signals are compared in the phase detector and if the oscillator is off-frequency, a correction voltage is developed and fed through the low-pass filter to the oscillator.

When you switch to the next uhf channel, which is 12.5 kHz higher, the oscillator shifts to 159.483 MHz. This is tripled to 478.45 MHz by the tripler and fed to the mixer. At the same time, the oscillator signal is divided by 38,276 by the programmable counter to produce the 4.1666-kHz signal. This signal is fed to the phase detector to be compared with the 4.1666-kHz signal from the 6.4-MHz oscillator and divider.

The signal at the output of the mixer is a 10.7-MHz signal. It is fed through a crystal filter to an i-f amplifier and a second mixer where it is converted to a 455-kHz signal. The signal is amplified further and fed to a discriminator and then through the audio amplifier to the output. Notice that the audio amplifier is controlled by the squelch circuit. When no signal is being received, the amplifier is blanked so you don’t have to put up with the annoying background hiss that would be present otherwise.

In addition to the signal used to control the oscillator frequency, the microprocessor sends signals to the memory that stores each channel frequency set up. The microprocessor feeds a signal to the LED driver, which drives the frequency display, and feeds another signal through the latches to the channel display driver, which in turn generates the signal that will cause an LED to indicate the channel is tuned.

Notice that the divider used with the 6.4-MHz oscillator divides down to 5 kHz or 4.1666 kHz. On the vhf bands, it divides to 5 kHz, since the various channels in the vhf band are spaced 5 kHz apart. On the uhf band, the channels are spaced 12.5 kHz apart so the divider divides by 4.1666 kHz. Three times this is 12.5 kHz.

The signal is divided to this frequency so that the same low-pass filter can be used on vhf and uhf, and because the oscillator is actually changed only 4.1666 kHz to change the signal fed to the mixer 12.5 kHz. If the divider divided to 12.5 kHz, separate low-pass filters would be required.

All told, the scanner is very well designed. It is an indication of the things to come as microprocessors are more fully exploited in consumer electronics.

The microprocessor is not some fantastic electronic device that is going to come into use some time in the future. It is here now. It is being used in automobiles to control the fuel-air mixture, to control the timing, to tell you how many miles you are getting per gallon of gasoline, and to tell you how far you can go on the gasoline in the tank. It is being used in the home in

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microwave ovens and home computers. It is being used in television receivers so that the receiver can be programmed in advance to record the various programs the viewer wishes to see. It will soon be found in practically every kind of electronic device that can be imagined.

Early in 1979, NRI will offer a new course in microprocessors and microcomputers. At the present time, we have prototypes of the microcomputer operating, and it is undergoing quality control tests both to ensure its reliability and to develop additional programming. We will have an innovative, highly original effective method for you to learn all about microcomputers. If you are interested in this new and exciting program, let me know and I'll send you information as soon as it is available.

William F. Dunn
Director of Education

When a tree burns, here's what goes up in smoke.

Now just imagine what happens when a whole forest burns.
Repairing or reworking printed circuit boards (PCBs) is a basic skill that every electronics technician must acquire. Most of the work involves soldering and unsoldering techniques used to mount, remove, or replace components. The only way to really learn this is through practice, but you must also have an understanding of the whys and hows.

In this article I will concentrate on a special group of PCBs, namely double-sided boards employing what are known as plated-through holes. We will begin by seeing what a plated-through hole is, and determine where and how it is used. Next will come a survey of tools and a discussion of methods for soldering, unsoldering, and repairing plated-through holes, with emphasis on good workmanship.

**WHAT IS A PLATED-THROUGH HOLE?**

As you may recall from your regular NRI lessons, a plated-through hole in a PCB is a hole that has had a conductive material deposited around its wall. The conductor is deposited by an electroplating process, and forms a solid, metallic connection through the hole from the copper foil pad on one side of the board to the pad on the opposite side. Glass fabric epoxy materials are best for boards with plated-through holes.

First the conductive pattern (traces and pads) is produced, usually by etching away the unwanted copper. Next, the holes are drilled or punched. Finally, the plating is deposited in all of the holes. Figure 1 shows a cutaway side view of a typical plated-through hole.

Let’s take a look at what a plated-through hole is good for. Figure 2 is a cutaway view of a PCB, showing a 14-pin DIP IC (dual in-line package,
integrated circuit) from its end. The various connections to its two extreme pins, numbers 1 and 14, are shown here in order to illustrate how plated-through holes are used in practical circuits.

Beginning from the left, the $V_{CC}$ bus connects to pin number 14 of the 7400 IC via trace C, hole number 1, trace B, and hole number 2. In this circuit, hole 1 is used merely as a connection between traces B and C. This was necessary in order to cross traces A and D, both of which run at right angles to B and C. You will see this done a lot in practical printed circuits because it is often impossible otherwise to get around an obstruction.

The other pin, number 1, is an input to a NAND gate in the IC. It is to be held high by the pull-up resistor. The connection between pin 1 and the resistor goes from hole 3, along trace E, to hole 4.

Glass fabric epoxy boards are expensive. Plated-through holes add considerably to the cost. In digital equipment, these boards will likely be crowded with DIP ICs. Such boards, with their numerous narrow copper foil traces on both sides of the board, are
very prone to accidental damage during any repair process. Plated-through holes complicate the job even more. So now we will see how to handle this work properly and save boards.

FIRST THINGS FIRST

There are certain principles of good workmanship you can learn that will help you to work skillfully with only a minimum risk of damage to those costly boards. It takes time to develop a sure hand. If possible, get some scrapped boards to practice on first. Even experienced technicians will do well to practice on a few scrapped boards when learning to use a new desoldering tool.

Keep your desoldering tools in perfect shape. Gradual wear of these tools usually goes unnoticed until the tool is nearly useless, or perhaps ruined. Regular (daily) periods for preventive maintenance of your tools will help ensure their long life. At such times you should clean or replace soldering tips, clear air paths, and clean filters in solder-sucking tools.

When your tools begin to wear, you will begin exerting more pressure on the working area, and you are likely to use more force and heat than normal. Also, the work will not be as clean and neat as it should be, and it gets harder. Watch for these signs. Then take time to get your equipment in shape before you start wrecking those costly boards.

The first thing you’ll notice about a plated-through hole is that it doesn’t solder (or unsolder) like ordinary surface solder joints. You have to apply heat to the joint for a longer time while the solder runs up the hole in a wick action. You know you have a good joint when the solder will run up the hole and start climbing the component lead on the opposite side. Figure 3 illustrates this effect.

Remember that too much solder causes shorts on the component side of the board. We’ll discuss this more thoroughly later on.

Now when unsoldering, the opposite occurs. That is, you want to get the solder to quit the component lead and vacate the hole, as well. If you don’t get all of the solder out, the remainder resweats the component to the hole, and you’ll yank out the plating along with the component. More about this later.

![Figure 3. A proper solder joint.](image-url)
Table 1

<table>
<thead>
<tr>
<th>Desoldering Tools and Aids</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soldering iron and solder-sucker</td>
<td>Simplest method. Works well enough. Frayed tips leak air when doing one pin at a time on ICs, but new tips are cheap. Apt to spray shreds of solder about, causing short circuits.</td>
</tr>
<tr>
<td>Desoldering braid</td>
<td>No good for plated holes. Heat doesn’t transfer well enough to melt all the solder in a hole.</td>
</tr>
<tr>
<td>14-pin and 16-pin DIL desoldering tips (branding irons)</td>
<td>Removes ICs fast (needs a steady hand) but does not clean holes. One slip and you can chew up a lot of thin traces. Most technicians I know prefer not to use this method.</td>
</tr>
<tr>
<td>Vacuum tools such as Pace Sodr-X-Tractor® or Weller DES-102 desoldering iron or Edsyn Model DSO17</td>
<td>Usually best to work with. Can normally remove all solder and clean hole in one operation, but only one hole at a time. At first, difficult to use correctly until practice makes perfect. Requires daily maintenance. Most expensive method.</td>
</tr>
<tr>
<td>IC inserters/pullers</td>
<td>Inserters fine for inserting ICs. Helps prevent bent pins. But when it comes to removing desoldered units, I have mixed emotions! Once I have all the pins clear of the hole wall, I prefer to slip a strip of cable tie underneath the IC and pull it out that way.</td>
</tr>
</tbody>
</table>

TOOLS

Table 1 lists my personal evaluation of the desoldering tools normally in use today. I have had actual experience with all of these techniques except the Weller. I have never worked with a DES-102 myself, but I have watched several operators use it, and it seemed to work very well. At work I use a Pace machine which I like very much. At home, I use the iron-and-sucker method. If you’ve never used a vacuum tool before, Fig.4 shows you the principle.

The tool shown in Fig.4 uses a hot, hollow tip. The heat melts the solder, then vacuum is applied through a tube in the opposite end and the solder is sucked away in the direction of the small arrows inside the hollow tip. The solder is gathered in a receptacle that must be emptied regularly or the tool will clog. Several companies make tools that work on this same or a similar principle.

At first, I found it very hard to use this type of tool. After two or three weeks, however, I finally got the knack. Most of my trouble was due to ignorance. I hadn’t bothered to read the instruction manual carefully, and was neglecting to select the correct size tip for the job. Nor was I cleaning the machine properly.

REMOVING COMPONENTS

Always bear in mind that the PCB itself is the most expensive component in the circuit. Occasionally, you’ll get into a situation where “something’s got
SOURCE OF VACUUM RECEPTACLE FOR WASTE SOLDER

HOLLOW TIP

FIGURE 4. VACUUM-OPERATED DESOLDERING TOOL (PRINCIPLE).

to give." When you do, make certain it's not the board that gives. Usually you can sacrifice almost any component in order to save the board.

Sometimes I catch myself stupidly struggling with a perfectly good PCB in order not to damage the faulty part that I'm trying to remove. If there is a reason to unsolder the part in the first place, why not be willing to damage it a little (or even completely) if it looks as though the operation otherwise could harm the board? Why was I removing the part anyway? Don't be afraid to mangle a part if that's the best way of getting it out.

But when you do decide to cut a component away, there is a right way and several wrong ways of doing it. As a general rule, always cut the leads as close to the component body as possible. In other words, cut a lead as far away from the solder joint as you can. Whenever you cut a lead, you give the plated-through hole and connecting foil a mechanical shock. The heavier the lead, the greater the shock. Incidentally, when cutting IC leads all the way up to the housing, the mechanical shock will probably shatter the plastic housing. Just make sure you clean up all the pieces so you don't leave any shorts around.

Once you have cut the component free, straighten the leads so you can suck them away along with the solder in the hole. Still, cut only those parts that won't come out the normal way!

Now a word about heat. Heat loosens the bonding between foil and substrate. So always allow plenty of time for a joint to cool off between soldering/desoldering operations.

CLINCHED LEADS

Equipment designed for rugged use may have the component leads bent flat against the pads on the solder side before being soldered. This is called "clinching." You have to be especially careful when unsoldering parts with clinched leads. The difficulty is that it is nearly impossible to clean away all the solder from the joints. There will almost always be some left underneath the lead, causing a sweat to the foil. If the leads are rigid, you risk tearing out the
pads if you try to unsolder and then straighten the leads. The easiest thing to do here is to clip the leads on the component side and then suck them through the hole, as described previously.

Where you can’t get at the leads to cut them from the top side, try one of these two suggestions:

1 For transistor and signal diode leads, thin resistors and capacitor leads, and light wires, refer to Fig.5:

   a Touch the hollow tip of the desoldering iron to the tip of the lead. Try to avoid touching the pad. Use a thin tip!

   b As the solder begins to melt, slide the desoldering tip more and more over the lead, while you lift and straighten.

   c When the lead is straight, go right over into the normal desoldering operation by applying vacuum as soon as all the solder in the hole melts.

2 For heavier leads that won’t readily bend, or if you’re using the solder iron-and-sucker method, refer to Fig.6:

   a Remove the solder as well as you can.

   b Slowly work miniature cutting pliers between the lead and pad, patiently snipping through the solder sweat until the leads snap free. (You can both hear it and feel it.) Then bend the lead gently away from the board with the closed plier jaws. Watch the foil — be careful not to tear it off the substrate.

Once you work the clinched lead free, you may find that the lead still sticks to the hole wall. With the lead straightened out, resolder the connection and – after a cooling period – unsolder as described in the next section. Even with all this care, there is still danger of ripping the pad loose, but it’s still a lot safer than trying to pry the leads free with a knife blade in one hand and a soldering iron in the other. That would be a very accident-prone method indeed.

Clinched IC leads require great care because they are packed so closely, and their pads are often very fragile. However, IC leads are easy to bend, and the method shown in Fig.6 works quite well.

![Figure 5: Unsoldering a Clinched Lead](https://www.americanradiohistory.com)
THE ART OF UNSOLDERING

It would seem that by now we have covered all there is to know about unsoldering. Believe it or not, there are still a few “tricks of the trade” that we ought to consider. Most important, let’s look into the subject of heat.

Every technician has to learn how much heat to apply for each job. I will only point out here that too little heat will have you pushing and twisting your iron. That amounts to physical violence and is dangerous to circuit boards and fingers. Too much heat, on the other hand, lifts pads and traces, scorches boards, and zaps semiconductors.

Heat transfer from the soldering tool to solder joints should be via the component leads and the solder, not pads and hole linings. Often I start by adding a drop of fresh solder to a joint before unsoldering. This helps transfer the heat quickly. (It is a good trick when unsoldering a DIP IC with a branding iron tip.) Hold the iron so as to apply most of the heat toward the component lead, and only enough heat to the pad area to melt the solder there. Watch the other side of the hole. When the solder melts all the way up, apply the suction to suck the hole clean.

Once the hole is sucked clean, lift the component lead away from the pad with the hollow tip. Then, while still applying vacuum, wiggle the lead around in the hole. This action cools off the lead while it is in motion and it won’t resweat to the hole wall.

If you don’t get the hole clean on the first try, never try to reheat it. With most of the solder removed, there’s no way you can get enough heat to the remainder without damaging the foil or the hole plating. Instead, let the joint cool down, then fill the hole up with fresh solder. (Don’t be too stingy.) Let the joint cool off again, then unsolder once more, allowing enough time for all the solder to melt before applying vacuum again.

If you’re using a soldering iron and a solder-sucker, once the solder is removed, try to jiggle the lead back and forth in the hole with your fingernail until you feel and hear it snap free. Then you can safely — though still gently — pull the component out.

As you know, proper unsoldering is even more demanding than soldering,
although you certainly have to keep your wits about you even when making a “simple” solder connection. Let’s take a look at what we should expect of a good solder joint.

**SOLDERING A PLATED-THROUGH HOLE**

The first time you ever solder a plated-through hole, you’re in for a surprise! Keeping the soldering iron tip on one side of the component lead, and applying solder to the other side, all goes as expected. The solder begins to flow around the lead and pad area nicely until... whoops! Suddenly the solder drops down the hole. That’s when you know that you’re doing a good job. Apply just a little more solder so the hole fills up. Afterward, look at the joint from the component side. The solder should look like it’s trying to leave the hole by crawling up the lead in a smooth, wick-like action.

The solder shouldn’t clump anywhere. If the solder has flowed through the hole correctly, there is a good, large area of mechanical and electrical contact between hole wall and component lead. There will be a natural swell of solder on the component lead, which is plenty. Solder should also flow slightly around the pad area, reinforcing the connection between foil and plated-through hole. There is no need to pile up more solder outside the hole, where it does no real good, and may in fact cause a solder bridge to an adjacent pad. Look again at Fig.3.

In this article, I have tried to avoid repeating information already contained in the regular NRI lessons. Most of the procedures and methods recommended here are based on advice from toolmakers or instructions from production and quality assurance engineering manuals. Some things I have just picked up by myself, or learned from fellow workers. I hope that I have introduced a few ideas that can upgrade your skill and increase your worth as an electronics technician.

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1 Conditional Class License eliminated. Novice power limit upped to 250 W. 
2 Technicians given Novice privileges. 
3 No new distinctive Novice call signs, although Novices may sign "/N.
4 No requirement to sign "portable" or "mobile" except foreign operators using reciprocal licenses. 
5 First "comprehensive" cw exam given in Washington, D.C. office. No solid copy for one minute requirement. 
6 Court case "temporarily" suspends all license fees. 
7 New interim licenses issued upon upgrade of license class at an FCC office. 
8 Secondary station licenses eliminated. 
9 97.95(a)(2) deleted. no notification of new address required. 
10 New emission purity standards. All spurious emissions down 40 db for transmitters operating below 30 MHz, down 60 db for transmitters of 25 watts or more operating between 30 MHz and 235 MHz (97.73). 
11 Code sending test deleted from Commission-administered examinations. 
12 97.95(b)(2) rescinded. Maritime Mobile in Region 2 may use all amateur frequencies. In foreign waters may use only frequencies authorized by regional government. 
13 Call sign structure making special calls available to various class license holders. 
14 Ban on commercial 10-meter linear amplifiers. 
15 Novice license term extended to five years, renewable. Technicians given full privileges above 50 MHz. 

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16 NRI Journal
You know, I guess it has been almost ten years now that there has been a Ham News column in the NRI Journal. That's really hard for me to believe, even though I was not involved with the first few columns 'way back then. In fact, I guess the first mention of amateur radio in these pages could not really be considered the start of a column as such, since the main purpose at the time was to get the names and addresses of amateurs who might be willing to help out with Novice tests for our then brand-new Amateur Licenses course.

It was about that time that the first suggestions of forming some kind of NRI net started coming in. Nothing much was done for a year or so, but as more and more people expressed an interest in a net, someone finally actually volunteered to do something about it. As I recall, it was set up on 20 meters (which left out the Novices!) and two or three nets were actually held. Then things sort of dried up and little else was done.

In going through the mail for the column this time, I was struck by the number of people writing once again asking about an NRI net. Well, maybe it's time to give it a try again. I would suggest that a frequency be selected that would include Novices (and Technicians) as well as Generals, Advanced, and Extras. This would put it on cw for a start, and would mean 80 meters, 40 meters, 15 meters, or 10 meters. Since NRI students and graduates are spread out all over the United States as well as the rest of the world, we should pick a band that has some chance of providing fair coverage around the globe. (Wishful thinking!) This would pretty much rule out 80 and 40 for those of us who don't have huge antennas and lots of power to compete with the QRN and QRM.

Old Sol, behaving as he is supposed to in the coming months, would make
15 or 10 a fairly decent choice. Both bands open up quite frequently these days, and stay up for some time. Besides, when things are going right, a dipole and 10 watts can sound like a kilowatt driving a four-element Yagi on 10 meters!

The problem, of course, is to try and coordinate a suitable time, date(s), and frequency. Just to sort of start things off, I will propose that we try 28.060 MHz on Tuesday, January 16 at 2000 (8:00 p.m.) Eastern Time. That’s long enough after the first of the year for everyone to be recovered. No time will be convenient for everyone.

I’ll be on and will call “CQ NRI” and see what happens. I still have only a vertical, so I should get out equally poorly in all directions (Hi!). If you don’t hear me, try calling “CQ NRI” yourself – maybe someone else will hear you and respond. Who knows, it just might work!

After that trial, I’ll wait for your comments and report in the next Journal. Maybe we’ll have to try 40 meters and compete with the broadcasters— I don’t know. At any rate, mark Tuesday, January 16, 1979 on your calendars (8:00 p.m. Eastern) and listen up on 28.060 MHz for a first effort.

Now, I think we will introduce you to a minicontest. To sort of go along with the NRI net idea, we have been thinking that it would be nice to have some NRI QSL cards as well. Actually, the QSL cards will be used as a sort of graduation present for students of the Amateur Licenses course who successfully get an amateur license as a result of their NRI course training. At the same time, we just might make these cards available to any NRI student or graduate for a nominal payment.

At any rate, the contest part is for you to submit a card design idea for our judges to consider. We don’t have much in the way of prizes, but the winner will get the first hundred cards off the press, and will receive a free one-year membership in the NRI Alumni Association.

You don’t have to be an artist. A sketch will do nicely. We would like to have the NRI initials displayed somewhere on the card, and we thought perhaps we might use the world/electron symbol that heads the Ham News column as well. One other thing: in order to make the cards as inexpensively as possible, yet allowing a two-color printing job, we would like the cards to be one-sided. That is, everything on one side of the card only. If you just can’t seem to make one like that, we might consider one with printing on both sides. However, first preference will be given to those entries having a design on one side only.

You can send your entries to me in care of the NRI Journal. We will notify the winner as soon as a reasonable time has passed for you to get some designs in to us. Just to set a date, let’s say that all entries must be received no later than the last day of March, 1979. Good luck!

Now let’s see who we have heard from since last time. As you can see, there are quite a few this time. And would you look at some of those calls! I don’t think I’ll ever get used to some of these new-fangled ones. Field Day just drove me bananas this year! How about AC8F, for example or N4ACB? Like, wow! Oh well, I guess I’ll have to learn to live with them. I can say one thing, though. If and when I ever get that old Extra ticket, you better believe I’m hanging on to my one and only original call... K4MKX.

Sort of got sidetracked there, so now on with the show.

KA2ACV wrote two notes to us. The first told of his acquisition of the Novice license and gave details on the station. Tom built and uses the SB104A with its power supply into both a horizontal vee antenna and a 4BTV
Hustler vertical, up about 25 feet. The second note was to tell us he had passed the General test, but missed the Advanced by one or two questions. Tom said he was going to try again in November, and might even go for Extra.

W2FEI wrote asking us a question that I completely forgot to research and answer. Marty has an old monitor scope (Heath H010) with a bad CRT socket. After checking the 3RP1 pin out, it would appear that the problem is probably just a bad socket, Marty, and if and when you replace it, I would suggest removing the parts from pin 11 (the tie point) to reduce the possibility of arcing in the future. If a new socket doesn’t do the trick, you probably have a bad CRT.

Judy, WB3GRT, writes that her dad first got her interested in Ham radio some 19 years ago, but it wasn’t until 1977 that she got her first ticket—the Novice. Now, after some NRI studying, Judy has received her General. She has a TS520 transceiver, a Hygain 18AVT vertical, and uses a Heath keyer on cw. Judy is also active on 2-meter FM with an IC-22S into an 11-element Yagi. In addition to amateur radio, she has a real interest in raising exotic plants such as the Venus-flytrap, pitcher plants, passionflower vines, and the like. Fine business, Judy, and we will certainly be looking for you on the dc bands.

WD5ILW says that he certainly enjoys his new Novice ticket, and he is looking forward to taking the Technician test in the very near future. At the present, Danny is using a secondhand SB102 along with various dipoles, but plans to get some 2-meter FM gear as soon as he gets the new license. His Novice ticket took only six weeks to be issued after he sent in the exam.

WB6IVR is a recent graduate of our Amateur License course. As a graduation present to himself he went down to the FCC office and passed his Advanced test. Nice going, Jim. He also is a “home-brew” artist and liked the ramblings in the last Ham News column on that subject. Jim’s first project was a keyer for his Heath SB104 transceiver, and he says he is looking forward to more projects in the future.

Bill, WB70JS, just upgraded to General, and says he completely forgot to let us know when he first got his
Novice ticket. His shack has some real old-timers in it: a Multit-Elmac AF-68 and a Mosley CM-1. Wow, I can remember drooling over these pieces of equipment when I first got my license back in 1951. They were brand-new then, and I always thought it would be neat to have a mobile transmitter (the AF-68) and receiver so I could work both mobile and fixed with the same gear. Today, most transceivers are set up this way, so big deal! Anyway, congratulations on the upgrade, Bill, and take good care of that gear!

WDØEDY first appeared in these pages in the May/June issue. Now John is back to tell us of his upgrade to Advanced Class as of April. Nice going, John, and we wish you the best on the Extra. Let us know when you make that one too.

WB1FHX keeps pretty busy these days. In addition to his NRI studies (Communications), Roger has been studying for the General license, which he just got, and is going to college full-time. Now, he is sort of stuck on 10 meters with his TS520 (with outboard digital display) since the only antenna he has is an old 11-meter job he “converted” to 10 meters. Roger says he was quite surprised when he made contact with a DK8 for the first time. Anyway, as soon as all the studies are out of the way, he is going to erect some more antennas just so he can try out that nice transceiver and get on 2-meters with the NRI Model 452, when he completes it.

KB2CU writes that as a student of the Communications course he had been reading the Journal and the Ham News column for quite some time before the ham bug bit him, but when it bit, it bit hard! After studying the Morse code from some cassette tapes, Peter went down to the FCC and got his Technician, Advanced, and Second-Class Radiotelephone licenses. Unfortunately, the new ham licenses meant he had to try out some new gear (TS820) so the NRI studies have sort of fallen by the wayside. Peter assures us that he has not dropped out. He’s just resting and will hop to the books any day now.

WA2SUJ was one of the several respondents who asked about the possibility of an NRI net. John has been a ham for several years and at present is using a Heath HW101 with a home-brew antenna tuner into a random-length wire antenna. He also has a TR22C on 2-meters, but is looking forward to completing the Model 452 later in his course.

On September 8 I got a phone call from Mike, K3MXP. We must have talked for the better part of half an hour, and I’m sure glad I don’t pay his phone bill! Mike is recuperating from a recent operation and just thought he’d call. He indicates that perhaps his greatest interest in ham radio is homebrewing. We went on and on about the old WW2 surplus gear (ARC5s, etc.) and how different things are today. Mike is presently waiting for a power transformer so he can get a GRC9 transceiver on the air. This unit will put out 50 to 60 watts, which is more than enough for Mike. For a backup receiver he has an R392. Presently he listens on this one using a 75-foot 3/4 loop antenna strung around the inside of his attic. Mike’s other interests include microcomputers (he has four different ones!) and radio-astronomy, and he would love to hear from anyone else who shares his interests. You can write Mike at: Mike Tauson, 7820 Roderich Drive, Pittsburgh PA 15237.

N4ACB writes that he got his ticket in June and operates on 80 and 2 only. On the former, Mike uses a TX-1 Apache, while on the latter he uses an HW-202 into a five-element quad. If anyone would like the details of his home-brew quad, send a self-addressed,
writing to the Secretary, N4VD: IAAH c/o Carl Crumley, 512 N. Harrison Avenue, Cary NC 27511. Maurice says that N4VD was instrumental in helping him to get his Novice ticket and in spurring his interest in amateur radio.

W6RHB says this is his third station license, and he got it when he recently upgraded to Advanced Class. Ted runs a TS520 into an all-band “vee beam” using a home-brew coupler. The antenna is fed with 500-ohm open-wire (balanced) feed line, an almost forgotten scheme these days of coaxial cable. I agree, Ted, and think balanced lines are great too.

AC8F says his new Extra call has been creating quite a stir on the bands since he got the call back a few months ago. I’ll bet it does, George. One of those new “funny” calls!

Some time ago, Harry, W9ABF, wrote asking for information on marine stations operating in the 500-kHz band. Rm/3 Scott C. Morris saw his request and very kindly sent him all the information he needed, so Harry is pleased with the results he got from the Journal request, even though Scott was the only one to reply (outside of me, and I was not able to give him all that he needed). I’m very glad you got what you needed, Harry, and good luck chasing those ships!

KBØAN writes that his studies have suffered drastically since he got his Ham ticket. I know what you mean, Ray – it happens to all of us. He got his ticket back in April, and bought out the station of a local Novice (Heath DX-40, Moeley CM-1) and hasn’t been quite the same since. After having the Novice ticket only a month, down he went to take the Technician, General, and Advanced tests. With this new stature the old rig had to go, and in its place is a Drake TR-4 he uses with a Butternut HF5V-II vertical. Ray liked the antenna
so much he went to work for the company that makes them and helps put the things together.

Take a look at all that DX at the end of the list. I know this is the first time I've had a ZS call, and the KH6 is perhaps the second in ten years. First, however, is VE4AEZ, Peter, who writes that he is a brand-new amateur (May 1978). He uses a Heath MT-1 transmitter and a "much revamped" BC-348B receiver on 80, 40, and 20 cw.

KH6JQT has had his license a year, but has only been operating for about six months. Yasuo likes 15 meters best and has only a whip antenna sticking out the window on the eleventh floor in a 32-story apartment building. He says the rf feedback is so bad he can run his SB104 to only 20 to 50 watts. That's real tough, Yasuo. Maybe you should try a wire dropped down the side of the building.

Last on the list, but by no means least, is ZS6BMN, Jan. Jan writes from South Africa that he is just about to complete the Communications course, and is looking forward to converting the Johnson CB receiver to 10 meters, a worthy project. In the meantime, he operates all bands from 160 to 10 with a multi-band dipole using some real fine equipment: KW-202 receiver, KW-204 transmitter, and a Drake SPR-4 receiver. His Heath SB-200 linear is seldom used. Jan’s latest “kick” is working OSCAR 7 and 8 on all modes. The equipment used for this consists of a Yaesu FTL21R for two-meter operation, an Argonaut and Microwaves module transverter for 432 MHz and various exotic antennas for 2, 10, and 70 cm. Sounds very impressive, Jan, and I only wish that I had more experience with such operations. Just one more facet of Ham radio that I’ll have to investigate one of these days.

Well, that about wraps it up for this time. Do consider the NRI net idea, and join the QSL design contest as soon as you can. I’ll be looking forward to hearing you, and from you. Very 73, Ted – K4MKX
Autumn 23

Program Awards

For outstanding grades throughout their NRI courses of study, these May, June, and July graduates were given Certificates of Distinction with their NRI diplomas.

WITH HIGHEST HONORS

Kenneth D. Anderson, Goderich ON Canada
Thomas Arbustik, Nanton Heights PA
William L. Austern, Richmond IN
Jerry T. Bardon, Fort Pierce FL
George M. Bentzel III, Moorestown NJ
Michael R. Berry, Mounds View MN
John R. Bost, Bemidji MN
William L. Bickford, Fort Worth NH
Robert J. Boyle, Portage IN
Paul H. Brenzel, York PA
Leonard Brass, Wallingford CT
Donald L. Blyson, Thorp WI
Francis O. Burgoyne, North Woodstock NH
Ray Earl Carwight, Case Canaveral FL
Richard T. Cherry, Beaumont TX
Frederick E. Clague, Jr., FPO New York
Kenneth G. Cark, Amosville MD
James Atton Cozby, Denton TX
Dale Oregen, Rockford IL
David T. Derry, Laurel DE
Terry H. Daniels, Staten Island NY
Charles Driver, Jr., Oakton VA
Rach C. Eberly, Pretty Prairie KS
Charles D. Ellis, Lake Charles LA
Vincent J. Furtan, Ewa Beach HI
Stephen H. Gleen, Cloquet MN
Theodore L. Gles, Othello WA
David H. Grundes, Virginia Beach VA
Larry Richard Haas, San Antonio TX
Carl E. Hart, Springfield OH
Donald K. Hileman, Man WV
Edward Howard, Garnett IN
Arthur Louis Hubert, Chippewa MA
John C. Hucke, Palos Hills IL
Dale R. Humphrey, Circleville OH
Geoffrey B. Hunter, Oak Harbor WA
Donald F. Kennebeck, East Camden AR
Albert J. Kern, Philadelphia PA
Norman L. Kissell, Maoris Hill IN
Donald W. Klaus, Plainview KS
Sadhu Singh Kundi, Middlesex England
Earl E. Leas, Jr., West Reading PA
John Maki, Duluth MN
Joseph T. Manna, Brooklyn NY
Lance C. Maser, Au Gres MI
Stephen A. Miller, Jr., Schenectady NY
Charles J. Mullen, Wallkill NY
James M. Nadeau, Tacoma WA
Jerry Don Neessen, Brooklyn NY
Michael R. Newcomer, Las Palms IN
Mark Arthur Owens, Saint Louis Park MN
Leon B. Pace, Jr., California MD
Jim W. Perry, Mesquite TX
James F. Raynarney NY
James D. Porter, Albion IL
G. Howard Poteteet, Cedar Grove NJ
Herbert Arthur Randall, Cheshire MA
Michael E. Roberts, Saint Charles MO
Ole Salazar, Silverton CO
Lyle Allan Schmeltz, F W Warren AFB WY
Wayne D. Schwall, Ivonston CT
Giles Serpeeff, Can-Chart PQ Canada
Dianne J. Sitte, Skier Bay WI
Lloyd E. Stemburg, Jr., Hixon TN
Donald P. Stein, Bethesda MD
Raymond Eugene Sylvester, Hamlin CT
Richard Leon Thor, Circleville OH
Robert D. Ungaro, Niagara Falls ON Canada
Archie Von Hohn, Benton IL
Frank Carver, St. George NM
William C. Wiggs, Levittown PA
WITH HIGHER HONORS

Gregory M. Adkinson, Elly MN
Charles R. Albury, North Lauderdale FL
Douglas A. Alexander, Racine WI
Bradford S. Amidon, Peterham MA
Edward Peter Arundine, Brooklyn NY
Gerald Anderson, Watertown NY
Raymond F. Appleby, Dunsfalin CO
Otto L. Arrana, Bayamon PR
Charles E. Arneson, Jr., Islaul TX
Wallace G. Armstrong, Clarksville TN
Eugene A. Aro, North Vancouver BC Canada
John Thomas Astron, Ossode MI
Kenneth Lee Ayers, San Jose CA
Sotomio P. Babula, Windsor Locks CT
Lewis A. Barnard, Skidbogg CO
Frank Bolttert, Tonawanda NY
George V. Basket, Otsis AFB MA
Charles Richard Beer, Shermans Dale PA
Charles R. Bestry, Fredericksburg VA
Emest V. Bell, Westville NJ
Richard F. Bivans, Roxbury CT
Kenneth M. Binger, Moundare SD
Walter T. Blassett, Jr., Norfolk VA
Charles E. Boatwright, Shelby AL
Francis J. Bolmanski, Erie PA
Joseph P. Bonden, Jr., Bronx NY
Daniel A. Boudreau, FPO New York
Howard Bouchler, Oshawa ON Canada
James Roger Brackin, Town Creek AL
Paul Bradley, Delaware OH
Arvel O. Bradford, Bucyry OH
Bobby Don Brandon, Stuttgart AR
William G. Brantick, Hughesville MD
William R. J. Bricker, Ellsworth KS
Robert Louis Brodeur, Huntsville AL
Robert Burkhardt, Jr., Morgan Hill CA
Ferguson J. Byars, Sun Valley CA
Michael Cahill, Bowmanville ON Canada
Robert John Cardinal, Warren OH
Donald Carr, Meadow Grove NE
James Henry Cason, Wildwood FL
Raymond J. Cayon, Cape Fair MA
Frank Gobbett, Brentwood NY
Wayne A. Cecill, Massillon OH
James Chapman, Sweetgrass MT
Michael J. Christian, Harvey LA
Don P. Clayton, Birmingham AL
G. A. Coffman, Chester SC
Robert W. Colman, APO New York
Terry E. Craig, Fairfax, VA
N. S. Connell, Fairton OH
Raymond Coronado, Los Angeles CA
Edwin Dale Cowley, Cushing OK
Robert E. Crane, Fairton OH
Michael J. Crane, Arco ID
Allen Lee Davis, Kouts IN
Harry G. Dawson, Jr., Richmond VA
Brent Charles Dayton, Regina SK Canada
Richard S. Deeds, Jr., Morgantown PA
James J. Derive, Wyoming MN
George A. DeWeese, Belton TX
Henry Dilenschneider, East Northport NY
John Edward Dingman, Plainfield IN
Peter John Ditto, St. Ann MO
Herbert O. Does, Jr., Brownsburg IN
Wayne M. Dodd, Doylestown PA
Thad A. Douglas, Jr., Hamburg AR
Billy R. Dovda, APO San Francisco
John M. Downey, Sudbury ON Canada
Cyrus Wayne Drake, Evansville IN
Elaine B. Drake, Frederick MD
Delton W. Drivery, Mountain Home AFB ID
Tim G. Dudley, Rupert ID
Mark Allen Dutches, Ridgway PA
Mel Duohon, River Ridge LA
James Henry Dunbar, Birmingham AL
Bobby L. Dunn, Seville TN
Kenneth R. Elich, Santa Maria CA
Carl R. Endres, Suttons Bay MI
Roiert Wayne Ferrin, Seguin TX
Anacletos R. Fiedela, Jr., Sin Antonio TX
Milard Lee Fischer, Kansas City MO
G. Fisher, Calgary AB Canada
William A. Fisher, Elkhart IN
Ewell T. Fletcher, Jr., Rockford IL
Kermit M. Floyd, Austell GA
Jeremy M. Foy, Linden MI
Le Roy C. Fries, Anchorage AK
Lester T. Frykes, Flint MI
Stephen E. Gall, Phoenix AZ
Adolph Galonsky, Boynton Beach FL
John J. Gassner, Jr., Fort Morgan CO
Roy W. Geiling, FPO New York
Nicholas T. Gorgoncy, Akron OH
Gordon M. Gibson, Barneget NJ
Julian L. Gilman, Fort PO PA
Lloyd T. Graham, Samuels ID
Howard V. Gray, Derby KS

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26 NRI Journal
Our most recent meeting centered around troubleshooting a black-and-white TV set. It was a small-screen Zenith tube-type with an age/tuner problem. The defect turned out to be a short circuit in the age amplifier tube socket.

We looked at a vintage (18 years old) Hughes tube-type dual-trace oscilloscope. We checked it for operation and analyzed the circuit. We determined that there was a defective part in the high-voltage section. We could not fix the scope as we did not have a correct replacement for the bad part.

David Bonnet has joined our Chapter. We are pleased to have him as a new member.

We were privileged to have representatives from the TV industry speak at two of our recent meetings. Tom Buetscher, Service Manager of the J. A. Williams Company, gave us a firsthand look at the new line of Zenith color TV sets. He went over the circuitry and physical construction of these sets. The members were interested to see that these sets use no metal chassis. Instead, the circuits are on panels that are interconnected by cables. Surprisingly, the HV, horizontal output, and tuners are all on panels. The interconnections are so carefully engineered that the panels cannot be connected incorrectly.

Tom explained that this new construction is used in both the 19-inch and
25-inch Zenith sets and that the panels can be exchanged in case of failure. The service technician has the option of repairing defective panels or exchanging them for new or rebuilt panels.

Bill StClair, an instructor in servicing for General Electric, gave a talk on the 1979 General Electric color TV sets. He distributed service literature and showed the changes that we should look for when we begin servicing these new sets. He used a new video cassette recorder for his presentation. The members were nearly as interested in the VCR as they were in his presentation.

We thank both of these gentlemen for helping us stay abreast of the TV industry. We look forward to similar programs in the future.

FLINT/SAGINAW VALLEY

The Flint/Saginaw Valley chapter has met every two weeks throughout the summer, except for the month of August. Most of us took vacations during August. One of our members, Andy Jobbagy, went to Hungary to visit his "home country."

Our meetings since the spring have been a mixture of service training sessions and discussions of test equipment and home electronic equipment. We have worked on numerous TV sets, black-and-white and color, tube-type and solid-state, current models and vintage TV sets. We have also worked on test equipment, including a Conar oscilloscope, automobile radios, and home intercoms.

We worked on an Airline black-and-white TV that had sound but no raster. We began our troubleshooting in the high-voltage section. After checking and replacing suspected parts, we found that the cause of the problem was a shorted audio amplifier tube. We put in a new tube and the set played perfectly. We

DIRECTORY OF ALUMNI CHAPTERS

DETOUR CHIRPTEY meets at 8 p.m. on the second Friday of each month at St. Andrews Hall, 431 E. Congress Street, Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Michigan. 841-4972.

FLINT (SAGINAW VALLEY) CHAPFER meets 7:30 p.m. the second Wednesday of each month at Andy’s Radio and TV Shop, G-5507 S. Saginaw Road, Flint. Chairman: Dale Keys. Phone (313) 639-6688. Shop phone (313) 694-6773.

NEW YORK CITY CHAPFER meets at 8:30 p.m. the first Thursday of each month at 1669 45th Street, Brooklyn, N.Y. Chairman: Sam Antman, 1669 45th Street, Brooklyn, New York.

NORTH JERSEY CHAPFER meets at 8 p.m. on the second Friday of each month at the Players Club, located on Washington Square in Kearny, New Jersey. Chairman: Al Mould. Telephone 991-9299 or 438-5911.

PHILADELPHIA-CAMDEN CHAPFER meets on the fourth Monday of each month at 8 p.m. at the home of Chairman Boyd A. Bingaman, 426 Crotzer Avenue, Folcroft, Pa. Telephone 563-7165.

PITTSBURGH CHAPFER meets at 8 p.m. on the first Thursday of each month in the basement of the U.P. Church of Verona, Pa., corner of South Avenue and Second Street. Chairman: George McElwain, 100 Glenfield Dr., Pittsburgh, Pa. 15235.

SAN ANTONIO (ALAMO) CHAPFER meets at 7 p.m. on the fourth Thursday of each month at the Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 block of N. New Braunfels St. (three blocks north of Austin Hwy.), San Antonio. Chairman: Robert Bonge, 222 Amador Lane, San Antonio. All San Antonio area NRI students are always welcome. A free annual chapter membership will be given to all NRI graduates attending within three months of their graduation.

SOUTHEASTERN MASSACHUSETTS CHAPFER meets at 8 p.m. on the last Wednesday of each month at the home of Chairman Daniel DeJesus, 12 Brookview Street, Fairhaven, Mass. 02719.

SPRINGFIELD (MASS.) CHAPFER meets at 7:30 p.m. on the second Saturday of each month at the shop of Norman Charest, 74 Redfern Drive, Springfield, Mass. 01109. Telephone (413) 734-2609.

found that the tube plate was connected to the horizontal output transformer. The short in the tube increased the current through the transformer winding so that the high-voltage section could not develop the usual high voltage.

Dennis Besser brought in a Philco color TV that had a good picture but no sound. The trouble turned out to be a bad audio output transistor. We located the trouble by injecting a signal at the volume control. We confirmed the defect with an ohmmeter and a transistor checker.

Jeff Cyphert had a little trouble with the Conar oscilloscope which he put together. Jerry Lev, who had assembled an oscilloscope previously, helped him trace the circuit and locate the problem. It turned out to be a fairly common wiring error. It is always helpful to have someone else look over your wiring, when possible.

In addition to sharpening our skills as service technicians, we managed to do some good for mankind in our Alumni meetings. We repaired several TV sets and gave them to charity. Some of the sets were completely inoperative when we received them so we gained experience in working on them before we passed them on.

We were pleased to welcome Thomas D. Sharp to our Alumni chapter. Tom is a student of the NRI Complete Communications Electronics course and he intends to become a CB service technician after completing his course.

NORTH JERSEY CHAPTER

Mr. Oswald (Tex) Judisch led a discussion on two-meter (144-148 MHz) ham radio. Tex, WB2HDV, is a retired ship radioman and a very active ham. He explained how the two-meter rig works and how repeaters are used in two-meter communications. Two-meter portables are low-powered and have limited range. Repeaters, therefore, greatly extend the range of reliable communications.

In a future meeting, we will have a slide presentation from GTE Sylvania on color picture tubes. We will also have meetings on the operation and use of electronic test equipment, including the new digital multimeters.

SPRINGFIELD (MA) CHAPTER

The last meeting was held at the home of Norman Charest, chairman of the Springfield Chapter. The Chapter joined forces in solving the problems in three color TV sets.

We worked on a Sylvania portable color set with vertical bars in the picture. We found the trouble in the screen grid circuit of the horizontal output amplifier stage. There was insufficient decoupling.

Next, we tackled a GE 19-inch color set with an hourglass-shaped picture. This pattern was caused by a defective deflection yoke. The vertical signal was getting into the horizontal deflection current waveform. Replacing the deflection yoke cleared up the trouble.

After solving the problem in the GE set, we turned our attention to a Zenith 25-inch color TV. This set had two black bars on each side of the picture. We traced the trouble to the screen grid circuit of the picture tube. We replaced a defective 820-ohm resistor and a 0.01-µF decoupling capacitor and the set worked perfectly.

Finally, we worked on a Bradford Model 1171B22 set with a high-voltage problem. We did not locate the trouble and decided to save it for a future meeting.

We postponed our annual picnic until we decide where to hold it this fall.
NEW YORK CITY CHAPTER

The chapter covered a variety of subjects at our most recent meeting. Chairman Sam Antman reported a funny, but common TV problem: operator error. Sam was asked to check out a remote control unit for a Sony TV. The remote unit worked fine but it would not control the TV set. It seems that there is a switch on the front of the TV set to disable the remote control. The customer’s five-year-old grandchild found the switch and switched it off. The customer did without the remote control for several weeks before he finally decided to “get it fixed.” The “fix” was to turn the switch back on. This customer, like many others, probably lost the instruction booklet before he got around to reading it.

Robert White reported that he had solved the problem of an overheating damper tube in a TV set which he had spoken about previously. The trouble was a shorted 570-ohm resistor in the damper circuit.

Previously, Pete Carter had brought to our attention an intermittent power supply problem in an Emerson TV. He reported that the defect was a bad electrolytic capacitor in the bridge rectifier circuit.

Before we adjourned, we brought out our Conar Model 600 color TV and went through the color setup procedure: convergence and gray scale and purity adjustments. The meeting ended with refreshments.

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Job Ops

ENGINEER/ANNOUNCER: Urgently needed for WWOD Radio, 2020 Mimosa Road, Lynchburg, Virginia 24503. Must have First-Class FCC Radiotelephone. Telephone collect (804) 384-1211.

HELP WANTED: Small-appliance repairman to operate own business in appliance store and earn commissions on TV and appliance sales. Contact Mutual TV and Appliance Center, 754 Main Street, Amherst, Massachusetts 01002.

TECHNICIANS WANTED: Growing automotive radio sales, service, and installation center needs technicians familiar with analog and digital electronics. First-Class or Second-Class FCC license helpful but not necessary. Contact Michael Montgomery, F&M Stereo Center, 5809 Jensen Drive, Loves Park, Illinois 61111.

CB TECHNICIAN WANTED: To repair and service CB transceivers. Experience or training in servicing preferred. Full-time permanent position. Contact Bob Jeffrey, Glen Ellyn CB Hut, 805 North Main Street, Glen Ellyn, Illinois 60137. Telephone (312) 469-5715.

OPERATOR/TECHNICIANS WANTED: For WXCL and WZRO-FM Stereo in Peoria, Illinois. Must have FCC First-Class Radiotelephone. Light programming of FM with DEC computer. Knowledge of transmitter remote control and calibration, ability to build small electronic projects in well-equipped shop, ability to solder very neatly. Knowledge of phasors, base currents, phase monitors, field intensity meters, and monitoring points is a plus. Contact Melvin Feldman, 3641 Meadowbrook Road, Peoria, Illinois 61604. Telephone (309) 685-5975.

SERVICE TECHNICIANS NEEDED: Growing TV/audio servicing business urgently needs service technicians. NRI students and graduates preferred, full-or part-time. Contact Roger Jones, Christian TV and Audio, 6916 Silverstar Road, Orlando, Florida 32808. Telephone (305) 293-7288.
## CONAR
A Division of the National Radio Institute
3939 Wisconsin Avenue
Washington, D.C. 20016

### CHECK ONE:
- Cash order
- COD (20% deposit required)
- Select-A-Plan order

### CHECK ONE:
- New Conar account
- Add-on Conar account
- Reopen Conar account

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**PLEASE PRINT**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>City</th>
<th>State</th>
<th>Zip code</th>
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Shipped to another address? Give directions here:

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>City</th>
<th>State</th>
<th>Zip Code</th>
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</table>

Moved since last order?

<table>
<thead>
<tr>
<th>Previous address</th>
<th>City</th>
<th>State</th>
<th>Zip code</th>
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### ORDER FORM

<table>
<thead>
<tr>
<th>Name of Item</th>
<th>Stock No.</th>
<th>How Many?</th>
<th>Price Each</th>
<th>Total</th>
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<tbody>
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**IMPORTANT:**
To speed handling, any correspondence should be on separate paper.
All prices are net FOB, Washington, D.C.
Please include postage for weight shown and insurance on Parcel Post orders.
A 20% deposit is required on COD orders. Select-A-Plan orders: Please complete reverse side and sign payment agreement below. Thank you for your order.

| 1. Total cash price for merchandise |
| 2. Parcel Post and insurance |
| 3. 10% cash down payment and Parcel Post costs required on new Conar accounts. |
| 4. Unpaid balance of cash price |
| (Items 6 and 7 less item 8) |
| 5. Sales tax |
| (Washington, D.C. residents only) |
| 6. Unpaid balance (Amount to be financed) |
| (Item 9 plus item 10) |

Prices in the Conar catalog and Select-A-Plan time payment privileges apply only to residents of the United States and Canada. Residents of Canada and foreign countries are responsible for customs charges.

**PAYMENT AGREEMENT**

Enclosed is a down payment of $ on the merchandise I have listed on the Conar Order Form. I will pay Conar a minimum payment of 7% of the beginning unpaid balance or $5 per month, whichever is greater, until the full balance plus applicable interest is paid. Title to and right of possession of the merchandise shall remain in Conar Instruments until all payments have been made. If I do not make the payments as agreed, Conar may declare the entire balance immediately due and payable. In satisfaction of the balance, Conar may, at its option, take back the merchandise, which I agree to return upon request. I agree that the above conditions shall apply to any add-on purchases to my account. The statements on my credit application are true and are made for the purpose of receiving credit.

Date: 

Signature: Buyer sign here

Please do not write in this space.
CONAR SELECT-A-PLAN
SELECT YOUR TERMS TO FIT YOUR BUDGET

CONAR FINANCIAL RATES
The Finance Charge on balances up to $500 is 1½% per month. On any portion of a balance over
$500, the rate is 1% per month. This is an Annual
Rate of 18% and 12% respectively. The Finance
Charge is computed on the month end balance of
your billing cycle. You will receive a statement
each month approximately 10 days before your
payment is due. It will give you the current
balance, finance charge, list payments made during
billing cycle, date your payment is due, and
amount of minimum payment due.

HOW TO DETERMINE THE AMOUNT OF YOUR
MONTHLY PAYMENT
The minimum monthly payment on a Conar
account is 7% of the original unpaid balance or $5,
whichever is greater. The 7% is calculated to the
nearest dollar. For example, if your original
balance is $140, your payment would be $10. If
your original balance is $160, your payment would
be $11.

And remember—every purchase carries the Conar
Guarantee—"the best in the industry."

TO SPEED SHIPMENT
1. Complete other side of this sheet.
2. Insert amount of down payment (at least 10%
of total order) and other information in
Payment Agreement on other side.
3. Sign Payment Agreement and fill in Credit
Application.

IMPORTANT: Additional purchases—Once your
credit is established and you have made at least
three payments on your account, you can "add
on" to your account with purchases of $20 or
more. No down payment is required for add-ons
of less than $100. If you are under 21, please have
the Payment Agreement and credit application
filled out and signed by a person over 21. He can
make the purchase for you and will be responsi-
ble for payment. If you have a Conar account
open or recently paid in full, just sign the Payment
Agreement.

NOTICE TO THE BUYER: (1) Do not sign this
agreement before you read it or if it contains any
blank space. (2) You are entitled to a copy of this
agreement.

IT'S AS EASY AS A - B - C TO OPEN A CONAR ACCOUNT
PLEASE ALLOW ADEQUATE TIME FOR NORMAL ROUTINE CREDIT CHECK. ONCE YOUR
CREDIT IS ESTABLISHED, ONLY YOUR SIGNATURE IS NEEDED TO ADD ON PURCHASES.

WHERE DO YOU LIVE?

Print full name_________________________Age_________________
Home address________________City________State____Zip code____
Home Phone________________________( ) Own home ( ) Rent
Rent or mortgage payments $________per month ( ) Married ( ) Single Wife's name____
No. dependent children____Previous address________How long?

WHERE DO YOU WORK?

Your employer________________________Monthly income $________
Employer's address____________________
How many years on present job? Position________
Previous employer______________________
Wife's employer_______________________Monthly income $________

WHERE DO YOU TRADE?

Bank account with____________________( ) Checking ( ) Savings ( ) Loan
Address______________________________
Credit account with____________________Address____________________
Credit account with____________________Address____________________
Total of all monthly payments including car $________
Instruments for the Eighties.

New from CONAR.

Model 281 Signal Generator

Now, from CONAR, an indispensable instrument for every electronics technician—with all-new solid-state circuits and DIGITAL READOUT!

Student Price
Only $89.50

Plus shipping and insurance
(Choose the CONAR catalog for Parcel Post and UPS rates)

KITS ONLY
until early 1979

Stock No. 281UK

Specifications

Accuracy: Better than 1 percent of displayed frequency. Attenuator: Continuously variable control provides a minimum attenuation of 40 dB at 30 MHz and below. Modulating Frequency: Low-distortion 1000-Hz sine wave. AM Modulation: Adjustable at the front panel from 0 percent to 50 percent or better. FM Modulation: True fm using a dual varactor modulator. Maximum Deviation: 0 to 40 kHz at 4.5 MHz, 0 to 80 kHz at 10.7 MHz, and 0 to 200 kHz at 21.4 MHz. Output: Unmodulated rf, amplitude-modulated rf, frequency-modulated rf, and 1000-Hz audio. Output Amplitude: 0 dBm (200,000 microvolts), 3 dB into 50 ohms, 180 kHz through 30 MHz. Second harmonic of any selected frequency between 180 kHz and 30 MHz is 20 dB below the fundamental output or better. Amplitude Variation: Over any single band is 6 dB maximum. Audio output (1000 Hz) is 8 volts peak-to-peak or better into 1 megohm. RF and Modulated RF: Continuously variable within five bands. Band A: 175 kHz to 545 kHz. Band B: 540 kHz to 1.610 MHz. Band C: 1.600 MHz to 4.310 MHz. Band D: 4.300 MHz to 13.510 MHz. Band E: 13.500 MHz to 30.500 MHz. Semiconductors: Five integrated circuits, four transistors, two dual-gate MOSFETs, two varactor diodes, four silicon diodes, five seven-segment LED displays. Power Supply: Transformer operated at 5 and 15 volts dc with integrated-circuit voltage regulation. Cabinet Size: 5½” high by 8½” wide by 6¼” deep. Weight: 4 pounds (net weight).
Instruments for the Eighties.

Model 312 Resistance/Capacitance Decade

From CONAR... another superb instrument for the electronics technician, with all-new solid-state circuitry and DIGITAL READOUT! Don't delay—order today from CONAR.

Only $53.50

Plus shipping and insurance
( Check the CONAR catalog for Parcel Post and UPS rates)

KITS ONLY until early 1979

Specifications

Capacitance Ranges: 10 pF to 100 pF, 100 pF to 0.001 µF, 0.001 µF to 0.01 µF, 0.01 µF to 0.1 µF, 0.1 µF to 1 µF.

Resistance Ranges: 10 ohms to 100 ohms, 100 ohms to 1 kilohm, 1 kilohm to 10 kilohms, 10 kilohms to 100 kilohms, 100 kilohms to 1 megohm, 1 megohm to 10 megohms.